

SUBSTRATE COATED WITH FUNCTIONAL FILM HAVING GRADATION PART AND ITS PRODUCTION METHOD

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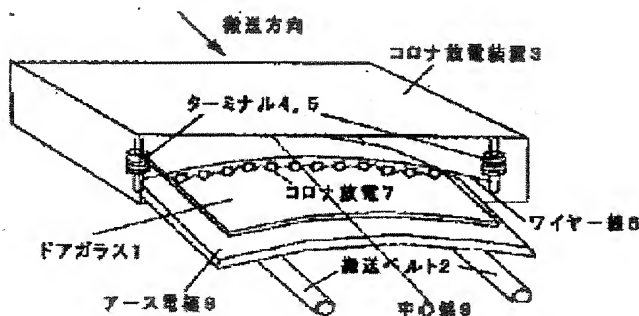
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Abstract of JP2001259515

PROBLEM TO BE SOLVED: To remove the gradation part of a functional film made from an organic compound or the functional film freely and easily by a dry process. **SOLUTION:** In the production of a substrate coated with the functional film having the gradation part in which the functions of a functional part in which the surface of the substrate is coated with the functional film made from the organic compound and the functional film are changed gradually, an area corresponding to the gradation part or a film removing part is subjected to corona discharge, exposure to plasma, or ultraviolet irradiation to form the gradation part or the film removing part.



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Notes:

1. Untranslatable words are replaced with asterisks (***).
2. Texts in the figures are not translated and shown as it is.

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CLAIMS

[Claim(s)]

[Claim 1] The functional film covering board which has the BOKASHI portion which the function of the functional division with which the functional film which consists of an organic compound was covered, and a functional film forms in the substrate surface the BOKASHI portion which changed gradually, and is characterized by things.

[Claim 2] A BOKASHI portion is a functional film covering board which the film thickness of a functional film is constant, and the concentration of a functional material changes, and has the BOKASHI portion according to claim 1 characterized by things.

[Claim 3] The functional film covering board which has the BOKASHI portion according to claim 1 or 2 characterized by a functional film being a water-repellent tunic.

[Claim 4] the functional film covering board which has the BOKASHI portion according to claim 3 to which the water-repellent portion and angle of contact whose angle of contact over waterdrop is the functional division which has water repellence of 70 degrees or more prepare the BOKASHI portion which was alike gradually and changed, and are characterized by things.

[Claim 5] The functional film covering board which has the BOKASHI portion according to claim 3 or 4 which adjoins a BOKASHI portion, prepares the non-water-repellent portion whose angle of contact over waterdrop is 20 degrees or less, and is characterized by things.

[Claim 6] A BOKASHI portion is a functional film covering board which has the BOKASHI portion according to claim 3 to 5 characterized by the angle of contact over waterdrop changing continuously.

[Claim 7] It is the functional film covering board which has the BOKASHI portion according to claim 3 to 6 characterized by the film thickness of a water-repellent portion and a BOKASHI portion being 20nm or less.

[Claim 8] A water-repellent portion and a BOKASHI portion are functional film covering boards which have the BOKASHI portion according to claim 3 to 7 which forms the water-repellent tunic which consists of a fluoro alkyl-group content Silang compound, and is characterized by things.

[Claim 9] [a function / the function of the functional division with which the

functional film which becomes the substrate surface from an organic compound was covered, and a functional film faces manufacturing the functional film covering board which has the BOKASHI portion which was alike gradually and changed, and] The manufacture method of a functional film covering board of having the BOKASHI portion characterized by performing processing of corona discharge, plasma exposure, or ultraviolet-rays irradiation to the field equivalent to this BOKASHI portion, and forming a BOKASHI portion in it.

[Claim 10] The manufacture method of a functional film covering board of having the BOKASHI portion according to claim 9 characterized by forming a BOKASHI portion by changing the processing time and/or processing intensity of corona discharge, plasma exposure, or ultraviolet-rays irradiation.

[Claim 11] The manufacture method of a functional film covering board of having the BOKASHI portion according to claim 10 characterized by changing the function of a BOKASHI portion continuously by changing continuously the processing time and/or processing intensity of corona discharge, plasma exposure, or ultraviolet-rays irradiation.

[Claim 12] After covering the functional film which becomes the substrate surface from an organic compound, the field equivalent to the non-functional division which adjoined the BOKASHI portion and was prepared Corona discharge, The manufacture method of a functional film covering board of having the BOKASHI portion according to claim 9 to 11 characterized by removing a functional film by performing processing of plasma exposure or ultraviolet-rays irradiation.

[Claim 13] The manufacture method of a functional film covering board of having the BOKASHI portion according to claim 9 to 12 characterized by a functional film being a water-repellent tunic.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the functional film covering board which has the BOKASHI portion in which the function of the functional film formed the BOKASHI portion which changed gradually in a part of functional film which consists of an organic compound covered by the surfaces, such as an object for construction, an object for vehicles, industrial use, and a mirror, especially water-repellent tunic **, and its manufacture method.

[0002]

[Description of the Prior Art] The following are known as main patent applications about the partial water-repellent-finish glass which has the portion in which the water-repellent tunic was formed on the substrate surfaces, such as glass, and the portion which does not form a water-repellent tunic.

[0003] for example, [JP,H7-157336,A] By the transparent board surface's having a water-repellent tunic formation part and a non-tunic formation part, and applying a

solvent to a non-tunic formation part when applying, so that the part may overlap with the coating liquid for water-repellent tunic formation. Decrease the film thickness of a boundary part gradually, it is indicated by the formation method of the water-repellent tunic which is not conspicuous and carries out a boundary with the agenesi s part of a water-repellent tunic, and [JP,H9-142888,A] A character, a pattern, and/or a pattern are patterned after the glass substrate surface. Form a transparent water-repellent tunic in the patterned this portion, and the ornament glass to which said patterning portion was floated according to the difference of the light scattering intensity at the time of moisture adhesion of waterdrop, a raindrop, etc. is indicated. A water-repellent film is given only to the wiper eradication portion of the windowpane for cars, and the partial water-repellent-finish glass with which the other portion does not give a water-repellent film is indicated by JP,H10-297939,A.

[0004] moreover, [JP,H11-194202,A] In order to prevent that a foreign substance adheres to the optical element surface in a manufacturing process, the provisional protection tunic which consists of an organic molecule substance which has the basis which does not carry out a chemical bond to the outermost layer substance of an optical element is formed. The optical element which sets and removes the foreign substance which adhered by ultraviolet-rays irradiation this provisional protection film on the surface of an optical element and on it by a final process is indicated.

[0005]
[Problem to be solved by the invention] [however, the manufacture method of the partial water-repellent-finish glass shown in above-mentioned JP,H7-157336,A, JP,H9-142888,A, and JP,H10-297939,A] The method of masking the portion which is not given a water-repellent finish and forming membranes, before giving a water-repellent finish, Or it is what produces partial water-repellent-finish glass by the way mask at the portion which does not remove a film after giving a water-repellent finish, and ceria polish, alkali treatment, etc. remove a water-repellent tunic. In the way they mask the portion which is not given a water-repellent finish before [said] giving a water-repellent finish while productivity cannot say easily that these methods are enough to adopt widely low practical The influence of the adhesion ingredient of a masking material remains in the substrate surface after masking removal, and the angle of contact over waterdrop also produces fault, such as becoming large.

[0006] Furthermore, that the method of JP,H7-157336,A controls continuously the water-repellent performance of the boundary region of a water-repellent tunic formation part and a non-tunic formation part or controlling the width of the boundary part exactly have the problem of a lot of waste fluid being generated difficultly. Moreover, the method of film removal given in JP,H11-194202,A is inefficient while it becomes all finally remove the formed provisional protection tunic, and complicated [a process]. Moreover, while the protective film ingredient decomposed is an organic polymer substance which has the basis which does not carry out a chemical bond to the outermost layer of an optical element, the

patterning method that the purpose is foreign substance adhesion prevention and removes some functional films of an application concerned differs in the purpose.

[0007]

[Means for solving problem] this invention person etc. found out the functional film covering board which has the BOKASHI portion which can manufacture the BOKASHI portion of a functional film or the film removal of a functional film which consists of an organic compound with a dry method with productivity easy still more sufficient free, and its manufacture method, as a result of examining many things in view of the conventional above-mentioned technical problem.

[0008] [namely, the functional film covering board which has the BOKASHI portion of this invention] The function of the functional division with which the functional film which consists of an organic compound was covered, and a functional film forms in the substrate surface the BOKASHI portion which changed gradually, and it is characterized by things, and this BOKASHI portion is further characterized by changing the concentration of a functional material and forming it, without changing the film thickness of a functional film.

[0009] [moreover, the functional film covering board which has the BOKASHI portion of this invention] It is characterized by a functional film being a water-repellent film. the angle of contact over waterdrop adjoins a BOKASHI portion, while the water-repellent portion and angle of contact which are the functional division which has water repellence of 70 degrees or more prepare the BOKASHI portion which was alike gradually and changed and are characterized by things, and the angle of contact over waterdrop prepares the non-water-repellent portion which is 20 degrees or less, and is characterized by things.

[0010] Furthermore, the functional film covering board which has the BOKASHI portion of this invention is characterized by the angle of contact over the waterdrop of a BOKASHI portion changing continuously. Furthermore, the functional film covering board which has the BOKASHI portion of this invention is characterized by the film thickness of a water-repellent portion and a BOKASHI portion being 20nm or less again, and further, a water-repellent portion and a BOKASHI portion form the water-repellent tunic which consists of a fluoro alkyl-group content Silang compound, and it is characterized by things.

[0011] [moreover, the manufacture method of a functional film covering board of having the BOKASHI portion of this invention] It faces manufacturing the functional film covering board which has the functional division with which the functional film which becomes the substrate surface from an organic compound was covered, and the BOKASHI portion from which the function of the functional film changed gradually. It is characterized by performing processing of corona discharge, plasma exposure, or ultraviolet-rays irradiation to the field equivalent to this BOKASHI portion, and forming a BOKASHI portion in it.

[0012] [furthermore, the manufacture method of a functional film covering board of having the BOKASHI portion of this invention] It is characterized by forming a BOKASHI portion by changing the processing time and/or processing intensity of

corona discharge, plasma exposure, or ultraviolet-rays irradiation. Furthermore, it is characterized by changing the function of a BOKASHI portion continuously by changing continuously the processing time and/or processing intensity of corona discharge, plasma exposure, or ultraviolet-rays irradiation.

[0013] [furthermore, the manufacture method of a functional film covering board of having the BOKASHI portion of this invention again] After covering a functional film on the substrate surface, it is characterized by removing a functional film by performing processing of corona discharge, plasma exposure, or ultraviolet-rays irradiation for the field equivalent to the non-functional division which adjoined the BOKASHI portion and was prepared. Furthermore, the manufacture method of a functional film covering board of having the BOKASHI portion of this invention is characterized by a functional film being a water-repellent film.

[0014]
[Mode for carrying out the invention] It is not limited especially if it is the tunic which consists of an organic compound as a functional film of this invention, and the tunic which consists of organic compounds, such as a water-repellent tunic, a **** cover tunic, an ultraviolet-rays cover tunic, a fog resistance tunic, and a coloring film, can be used. Moreover, it is also possible to use for the film which consists of an organic-inorganic matter hybrid other than an organic compound. In addition, the function of the functional film of this invention says water repellence, **** cover nature, ultraviolet-rays cover nature, fog resistance, coloring, etc. to the aforementioned functional tunic, respectively.

[0015] Below, a water-repellent tunic is taken for an example as an example of representation of the functional film of this invention, and the functional film covering board which has the BOKASHI portion of this invention, and its manufacture method are explained. The water-repellent tunic of this invention can be manufactured, for example according to the following process.

(1) The process which forms a water-repellent tunic by drying after applying water repellent liquid all over the single-sided surface of a glass substrate, (2) The process which removes this film and forms a non-water-repellent portion by performing processing of corona discharge, plasma exposure, or ultraviolet-rays irradiation for the water-repellent tunic of the portion equivalent to a non-water-repellent portion, (3) The process which forms a BOKASHI portion by performing processing of corona discharge, plasma exposure, or ultraviolet-rays irradiation for the portion equivalent to a BOKASHI portion.

[0016] ***** which consists of a fluoro alkyl-group content Silang compound as water repellent liquid which forms a water-repellent tunic, for example, After carrying out specified quantity mixture of the solvent for dilution, and the aqueous acids as a catalyst, predetermined time churning can be carried out, a hydrolysis reaction can be made to be able to end, subsequently to this solution a dehydrator can be added, and it can obtain by performing predetermined time drying processing and carrying out heavy condensation.

[0017] As the above-mentioned starting material, are a fluoro ARUKIRU alkoxysilane

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glass substrate activate the reaction of the Syros Knoll machine of water-repellent ***** and the hydroxyl group on the surface of a base material, below its about 75%RH is [atmosphere humidity] usually desirable but, and it is not limited to these. The intensity of a tunic etc. increases and is desirable when surface modification is carried out by carrying out acid treatment of the surface of the glass substrate which applies water repellant liquid beforehand. As for the film thickness of a water-repellent tunic, it is desirable that a child's lamination takes several minutes from an about 10nm single molecule on the average about 20nm or less. Since this compound of the water-repellent tunic formed from said fluoro alkyl-group content Silang compound etc. is a reactant (chemical bond nature) high compound with a glass substrate, the obtained water-repellent tunic is in the state where it combined with the glass substrate surface firmly.

[0024] Although a plastic besides the above-mentioned glass; metal, ceramics, etc. do not limit the quality of the material especially as a substrate used for this invention, especially in the case of a water-repellent tunic, in the case of transparent boards, such as glass and a plastic, it is effective, and desirable. When the water repellant liquid applied to the glass surface carries out dryness hardening at the temperature of about 150 degrees C or less continuously, the water-repellent tunic covering glass with which the water-repellent tunic was formed in the whole surface is obtained. In addition, even if it makes it neglect and harden at room temperature depending on the case, it does not interfere.

[0025] Next, how to form a non-water-repellent portion from the water-repellent tunic covering glass with which the water-repellent tunic was formed all over the single-sided surface of a glass substrate is explained below. First, [without establishing a **** object, when the portion which wants to remove a water-repellent tunic is band-like] Impress the high voltage to the part of a portion to carry out tunic removal at an electric discharge wire, expose the portion which passes directly under [this] a wire to corona discharge, and a tunic is degraded. It is also possible to carry out impression of the voltage of an electric discharge wire to the part of the portion which does not remove a tunic only by the change of the ON/OFF control of electric discharge of setting to OFF etc.

[0026] moreover, to remove a water-repellent tunic to a more complicated pattern It is also possible to arrange **** objects, such as masking material for ****(ing) the portion which is not removed and *****, into a portion [a portion] to make it remove a water-repellent tunic so that corona discharge or plasma can be exposed only to the portion which wants to remove this tunic. In addition, a **** object may be arranged right above close to the substrate which is the body to be exposed, or may be established near the electric discharge wire. Moreover, as masking material, Corona or ion plasma by electric discharge are not limited, especially if **** is efficiently possible, masking material, such as a plastic film, can be used, and the portion which does not remove a film can also be covered by direct masking material. When especially based on ultraviolet-rays irradiation, the method of carrying out irradiation processing using a masking board from which the ultraviolet-rays intensity

which penetrates a gobo changes continuously is effective.

[0027] Exposure of corona discharge can be performed as follows. About the exposure conditions (an output, an output frequency, an output waveform, time of exposure, distance to a tunic, etc.) of corona discharge, an optimal condition can be suitably chosen by the kind of base material, the membraneous quality of a water-repellent tunic, film thickness, etc. The output of corona discharge can adjust a sine wave and time of exposure by changing time for abbreviation 35kHz**5kHz and an output waveform passing the bearer rate of substrate glass through the processing side of this glass in the range of about 0.1 to 3.0 m/min, as for about 0.1–2.0kW and an output frequency. Moreover, the distance of an electric discharge electrode and a ground electrode board needs to be referred to as about 10mm or less, and it is good for the distance to an electric discharge electrode and a tunic to be about 2.5mm preferably about 2–5mm in consideration of the thickness of glass. On the other hand, when exposing plasma, the output can make the bearer rate of substrate glass similarly about 0.1 to 3.0 m/min as about 0.1–2.0kW and time of exposure. Moreover, the distance to electric discharge Gand and a tunic is preferably good to be referred to as about 8–10mm about 2–30mm. In addition, in the cast which bends in a plasma jet since the ground electrode is unnecessary, and has the form of two dimensions, such as glass, or three dimensions, it is more suitable.

[0028] As mentioned above, if energy-rich corona discharge, plasma, or ultraviolet rays are exposed to the fluoro ARUKIRUSHIRAN compound (FAS) which is a water-repellent tunic The Si-C combination and C-C combination in this FAS are cut by the electron and ion (Corona, plasma) in the state where it had very high energy, and it decomposes and deteriorates by them. At this time, it is appropriate for time of exposure to consider it as necessary minimum, and since it not only reduces productivity, but the temperature of substrate glass rises unusually or the yield of harmful ozone increases, processing unnecessarily for a long time is not desirable. In addition, when masking material is stuck on the direct tunic surface, this masking material can be removed, flush and dryness can be performed, and the partial water repellence glass with which only the portion covered by masking material has a water-repellent tunic can be obtained.

[0029] Next, the formation method of a BOKASHI portion is explained. In the glass substrate which removed the water-repellent tunic and formed the non-water-repellent portion by carrying out corona discharge treatment as mentioned above A non-water-repellent portion only for a bearer rate, without changing from from the voltage impressed in the non-water-repellent portion, immediately after a wire line arrives at the field equivalent to a BOKASHI portion The bearer rate at the time of formation, for example, 0.1 – 2.0 m/min -- a divisor -- it is made to change during a second, and the power supply of corona discharge is turned off simultaneously (OFF) conveyed by the usual bearer rate (2.0 m/min) immediately after that. The BOKASHI portion which an angle of contact increases continuously over a certain width by this processing has been formed. It is possible by choosing suitably conditions, such as time changing a bearer rate and a bearer rate and time turning off corona discharge,

o choose from the width of a BOKASHI portion and a water-repellent portion free inclination of the angle of contact over the water which results in a non-water-repellent portion etc.]. In addition, it is possible by choosing suitably conditions, such as time changing a bearer rate and a bearer rate and time turning off equipment, like said corona discharge also in plasma exposure to choose from the width of a BOKASHI portion and a water-repellent portion free [inclination of the angle of contact over the water which results in a non-water-repellent portion etc.]. Moreover, the width of a BOKASHI portion, an angle of contact, etc. can also be changed free also by choosing the exposure intensity of corona discharge or plasma exposure processing. Change of an angle of contact does not correspond to change of film thickness performing processing of corona discharge, plasma exposure, or ultraviolet-rays irradiation for a water-repellent tunic as mentioned above, and forming a BOKASHI portion. It is thought that it is dependent on the covering rate or covering area of the concentration of the fluoro ARUKIRUSHIRAN system compound formed on the glass substrate, i.e., a fluoro ARUKIRUSHIRAN system compound. [0030] In addition, this invention may form only a water-repellent portion and a BOKASHI portion, without preparing a non-water-repellent part in the substrate surface rather than being limited [for example,] to the above-mentioned example. Moreover, a BOKASHI portion may change continuously the angle of contact which shows water-repellent performance, and can be suitably chosen as stair-like ** according to the purposes, such as making it change gradually etc. Moreover, the aforementioned example carried out film removal of the field equivalent to a non-water-repellent portion, after forming the water-repellent tunic all over the single-sided surface of a substrate, but when covering a water-repellent tunic depending on the case, it masks at a non-water-repellent portion, and is not limited [form / a non-water-repellent portion]. Furthermore, although the above described the processing method by corona discharge, plasma exposure, or ultraviolet-rays irradiation, in processing by various dry methods, such as ion etching and electron irradiation, it cannot be overemphasized by changing processing time and processing intensity that the same effect is acquired.

[0031] [the water-repellent ***** glass which has the BOKASHI portion of the water-repellent tunic obtained by the aforementioned method] In order to discover the water repellence excellent in the water-repellent tunic covered by the glass surface It is important to have suitable angle-of-contact θ (degree) and the suitable fall nature Δ (mul), for example, angle of contact θ is more preferably good as a water-repellent portion to consider [of 70 degrees or more] it as 90 degrees or more, and, as for the angle of contact of a non-water-repellent portion, it is desirable to consider it as 20 degrees or less. The angle of contact of a BOKASHI portion can be made into the middle of said water-repellent portion and a non-water-repellent portion.

[0032] In addition, in particular when a substrate is glass, it is not what is limited to colorlessness or coloring and its kind or a color tone, form, etc. Furthermore, while bending and being able to use it with various tempered glass, intensity rise glass, and

a plate and a single plate, of course as sheet glass, it cannot be overemphasized that it unites and can be used also as glass. Furthermore, that by which various kinds of tunics, such as an ultraviolet-rays cover film, a **** cover film, and a conductive film, are formed in the glass in-the-car side surface does not interfere, either. Although the example in the case of a water-repellent tunic was explained as a functional tunic, using glass as a substrate about the above-mentioned, it is possible to obtain substrates, such as a plastic, and the substrate from which various kinds of functional tunics were partially removed by the method with the same said of other functional films.

[0033] Although it can use for the object for construction, the object for vehicles, industrial use, a mirror, etc. as a use of the functional film covering board which has the BOKASHI portion manufactured by this invention, it is not limited to these uses in particular. [in the case of the door glass for cars] for example, by using the neighborhood of the portion which receives sliding with the stabilizer of this door glass as the portion which does not form a water-repellent tunic for a band-like field, and using other portions as the partial water-repellent glass in which the water-repellent tunic was formed Although the angle of contact over the water of the water-repellent tunic formation portion in case of rainy weather is about 70 degrees or more, a non-water-repellent portion is about 10-60 degrees or less of the same angle of contact as the usual glass surface and the portion from which an angle of contact with waterdrop differs in the same glass side lives together In case of rainy weather, a driver becomes possible [spacing a portion with a large angle of contact in which the water-repellent tunic was formed, and seeing the scene outside a door mirror or a car clearly], and can usually improve safety. If a water-repellent tunic is formed in the whole surface also including the portion which slides with a stabilizer in the above-mentioned case It wears out earlier than other portions, the angle of contact of the portion which slides with a stabilizer falls sharply, the portion comes floating in the shape of a line especially in case of rainy weather, and the tunic of this sliding portion is no longer that of an exterior good better potato.

[0034] In addition, it is possible partial only at ON/OFF operation of corona discharge in comparatively simple partial processing to un-give [which un-gives only the front portion of door glass a water-repellent finish] a water-repellent finish, and attachment of masking material is fundamentally unnecessary. Of course, it is also possible to correspond by attachment of masking material, when complicated patterning is required, or to form a shield between an electrode and a glass side instead of masking material. Furthermore, it is also possible to shorten processing time further by plurality-ization of an electric discharge wire. Moreover, although the form of an electrode does not interfere by the shape not of a wire but needlelike **, since it tends to operate the shape of a wire, it is desirable.

[0035]

[Working example] An example explains this invention concretely hereafter. However, this invention is not limited to this example.

[0036] (1) The door glass for cars was prepared as a preparation board of glass.

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After grinding the glass surface of the vehicle outside of the door glass for cars by brush PORISSHA using polish liquid (thing made [MIREKUA made from the Mitsui Mining & Smelting industry etc.] to **** in water about 1%), it fully washed. Subsequently, "acid treatment" immersed for 1 minute into 35 degrees C and 0.1N sulfuric acid solution was performed.

[0037] (2) It gave a water-repellent finish all over the single-sided surface of the door glass for water-repellent-finish cars. Water repellent liquid was applied (45%, about 4ml/pc of water repellent liquid was dropped at the glass substrate under the environment of RH, and the cheesecloth (brand name; BEMCOT) extended 23 degrees C enough all over glass), it was air-dry for 5 minutes, and a water-repellent finish obtained the water-repellent tunic. In addition, water repellent liquid uses heptadecafluorodecyl trimethoxysilane ($\text{CF}_3(\text{CF}_2)_7\text{CH}_2\text{CH}_2\text{Si}(\text{OCH}_3)_3$: describe it as product KBM made from Shin-etsu chemistry-7803, and Following FAS) for *****, To a diluent solvent at isopropyl alcohol (i-PA) and an acid catalyst [0.1N nitric acid (HNO_3)] After mixing by 1:25:0.3 by the bulk density and agitating at room temperature for 2 hours, respectively, the 5 times (weight)-as many dehydrator (molecular sieve 4A considerable article) as FAS was put into mixed sol, drying processing was carried out for about 16 hours, and, finally it filtered and obtained through filter paper.

[0038] (3) As opposed to the door glass for cars with which the water-repellent tunic was formed all over the vehicle outside of the above (2) using film removal corona discharge equipment Non-***** (20 degrees or less of angles of contact) of the back side is carried out in general from the center on the surface of glass. Then, after passing through the BOKASHI portion which an angle of contact increases continuously over about 100mm, an angle of contact explains concretely below the manufacture method of partial water-repellent tunic glass of having the BOKASHI portion which has the water-repellent tunic which shows 105-110 degrees.

[0039] First, as shown in drawing 1, on the conveyance belt 2, the door glass 1 given a water-repellent finish all over the single-sided surface of glass turns this tunic side up, is laid, and is carried in in corona discharge equipment 3 (made by CT-0212 Kasuga Electric Works, Ltd.). In addition, the cylindrical terminals 4 and 5 are arranged at both the sides that sandwiched the conveyance belt 2, and between these terminals 4 and 5, corona discharge equipment 3 is stretched so that distance with the wire line 6 which is the surface of door glass 1 and one electrode which have curve form may become equal. Moreover, the aluminum board was installed so that the undersurface of door glass 1 might be met as a ground electrode 8. If the door glass 1 with which the water-repellent tunic was covered all over the vehicle outside (convex side) of door glass 1 is carried in in this corona discharge equipment 3, the voltage of 0.4kW will be simultaneously impressed to inter-electrode, and the corona discharge 7 will be exposed covering full [of the cross direction of this door glass 1] from full [of the wire line 6]. The angle of contact of the surface after that the glass bearer rate at this time is constant to 0.1 m/min, then processing became about 10 degrees, and the water-repellent tunic was removed completely and it was

hydrophilicity-ized.

[0040] subsequently, immediately after the wire line 6 arrived at the field equivalent to a BOKASHI portion, from from, the bearer rate was changed to 2.0 m/min in about 6 seconds (0.1min) from 0.1 m/min, and the power supply of corona discharge was turned off simultaneously (OFF) conveyed by the usual bearer rate (2.0 m/min) immediately after that. By this processing, the angle of contact over waterdrop formed the BOKASHI portion which increases continuously over about 100mm width. Change of the angle of contact on the center line 9 of the water-repellent film covering glass 1 which has the BOKASHI portion obtained by drawing 1 (drawing 1) is shown in drawing 2 . Thus, the angle of contact of the BOKASHI portion was changing continuously in the shape of a straight line mostly from about 10 degrees of a non-water-repellent portion to 105 degrees of a water-repellent portion.

[0041] In addition, since the length of glass changes variously with types of a car, it can change the pattern of angle-of-contact change of a BOKASHI portion by changing exposure conditions, such as an electric discharge output and distance of a wire 6 and glass. Furthermore, when using for real production, the output of corona discharge is in the state which kept the distance from 0.4kW and the electric discharge wire line 6 to the glass surface at 2.0-2.5mm. The bearer rate at the time of carrying out corona discharge was only changed with 0.1 - 2.0 m/min, and adjustment with the processing process of order was also good. Moreover, in processing of the above-mentioned non-water-repellent portion, even if it makes a bearer rate increase to 0.5 m/min, an angle of contact is 20 degrees or less, and it is also possible to shorten processing time also by extension of **** of a bearer rate or the number of an electric discharge wire.

[0042] Furthermore, in film removal of the above-mentioned water-repellent tunic, the angle of contact over the waterdrop on the surface of glass processed and obtained by various bearer rates in the above-mentioned corona discharge equipment (however, the distance of the wire line 6 and plate glass stretched the wire line so that every portion might become equal) was tested. The result is shown in drawing 3 . a result -- drawing 3 -- being shown -- as -- an angle of contact and a bearer rate -- it was admitted by almost positive correlativity's being in between in a certain bearer rate field, and changing a bearer rate with a certain fixed acceleration that it was possible to change an angle of contact continuously.

[0043]
[Effect of the Invention] This invention functional films, such as a water-repellent tunic formed beforehand, [with corona discharge, plasma exposure, or ultraviolet-rays irradiation] a short time -- [a desired portion is removed alternatively efficiently and simple, and a non-water-repellent portion is formed, and] especially as the formation method of a BOKASHI portion It can form by changing continuously processing time or processing intensity, such as corona discharge, plasma exposure, or ultraviolet-rays irradiation, to functional films, such as a water-repellent tunic, and changing the angle of contact of a BOKASHI portion continuously. Moreover, to "the usual water-repellent-finish glass which gave the whole surface a water-repellent

finish" obtained from the process as the existing line that a water-repellent finish is completely the same, this invention can remove ***** partially and alternatively as post-processing, and since it is a dry method, it has higher efficacy, like a process's being very simple and productivity are high.

[Translation done.]